17°. The moon remained bisected by it throughout the entire visibility.

Only the brighter stars were visible, on account of the thickness of the sky, and hence its exact dimensions could not be accurately determined from the want of comparison stars. An endeavour was made to secure pointings on different portions of the ring with the 12-inch equatorial by sighting along the tube, but this was found to be impossible because of the narrowness of the slit in the dome, which prevented its being seen with sufficient distinctness.

At 9h. 17m. Algol was on the inner edge of the extra ring near its junction with the ring surrounding the moon.

At 9h. 20m. Castor was central on the ring, and at 9h. 24m. this star was on the inside edge. By this time the ring had almost entirely disappeared, only a fragment of it being visible at Castor. After this it was not seen again, though the ordinary ring remained visible for several hours. When the extra ring was disappearing, the ordinary ring became brighter, and at 10h. 30m. a bright spot (a moon dog?) became visible on its north edge.

At 8h. 50m. α Orionis was bisected by the ordinary ring, from which the diameter was found to be $48°\cdot 9$.

Following are some estimations of the position of the extra ring. At 8h. 50m. a line prolonged through Pollux and Castor would touch the extra ring $8\frac{1}{2}°$ from Castor. At this time Capella was by estimation (a difficult and rather uncertain determination) about one-fifth of the radius of the ring north-east of its centre. At 9h. 0m. the ring passed 7° from Castor in the line to β Aurigæ, at which time Capella was by estimation $4\frac{3}{4}°$ north of the edge of the regular lunar ring.

The phenomenon was witnessed by Mr. Frank Sullivan, assistant in the large dome, and myself. I do not know that anyone else saw it.

I have never seen a similar phenomenon to this, and as it must be a rare one with reference to the moon I have thought it worth while to record the observations in NATURE. I understand that something of the kind has been seen previously with reference to the sun.

A careful drawing was made of the phenomenon, a copy of which is reproduced in Fig. 1. The exact time of the drawing is 8h. 50m. (6h. 0m. slow of Greenwich). This will explain itself. In making the drawing the two rings have been assumed to be of the same size. E. E. BARNARD.

Yerkes Observatory, Williams Bay, Wis., U.S.A., April 8.
Longitude 5h. 54m. 13s.·2 W., Latitude +42° 34′ 13″.

The Education Bill.

THE Education Bill now before Parliament is of so comprehensive and important a character that it deserves to be considered from various points of view. That which is most germane to the readers of NATURE is perhaps the influence it may have upon advancing or retarding the progress of natural knowledge.

It is generally now admitted that the old notions of education, both as to subject and method, require to be improved, and that the recent advance of science, and of the applications of science to industry, claim a much larger share of attention than in days of yore. The best schools are opening their doors to this knowledge, if not welcoming it, and any change in the management of schools ought to be in this direction. How far will the present Bill fulfil this requirement? It says nothing about the curriculum of the schools, and concerns itself solely with the constitution of the local education authority, and the machinery for raising and distributing the necessary funds and for appointing representatives on the management of the schools. The personnel of the managers in the first instance may not be much changed, but their powers may be seriously limited by their superior authorities, who have the revision of the expenditure and the settlement of the rate to be levied. The influence of the electors in School Board districts will be lost; an influence which at the present time is generally directed towards rendering the schools of as much practical value as possible. The Act of 1870 secured the coming forward of men or women sufficiently interested in the subject to stand the ordeal of a popular election, and who, when elected, worked under the stimulus of public responsibility; whereas under the present Bill the managers of transferred schools will apparently retain their office indefinitely, and the nominees of the new local educational authority will always be in a minority and therefore unlikely to be able to develop the newer ideas of education.

Our methods are undergoing a slow but very real change; good object-lessons from the infant classes upward, involving the proper use of eyes and hands, are coming to the fore; with a training afterwards in such branches of natural history and physical science as may bear on the probable occupations of after life—agriculture, mining, manufactures, trade, &c.—or on domestic pursuits. Much of England's prosperity in the future will, in fact, depend upon the proper adaptation of this fundamental training to the wants of the various sections of the community. Hence the paramount importance of selecting such persons as shall not only be acquainted with the wants of the neighbourhood, but shall also be imbued with the importance of this kind of teaching.

It is interesting in this connection to observe that the statistical returns of the Board of Education show that in the schools under the management of popularly elected bodies the attention given to the scientific subjects of instruction is more than twice as great proportionally as that in the "voluntary" schools. These returns have shown a gradual advance in this respect since 1890, except that in 1899-1900 there is a small retrogression perceptible in most of the subjects, including mechanics, animal physiology, chemistry and general physics. (See British Association report on "Teaching of Science in Elementary Schools," 1901.) The cause of this is not obvious, and it is impossible to say whether it continues, as the figures for the year 1900-1 are not yet issued.

Small schools are always worked at a great disadvantage, as the children attending them cannot be properly divided into classes and have almost necessarily to be taught by one teacher. This cannot be avoided in districts of very sparse population; but the Government Bill gives direct encouragement to the multiplication of small schools, each of which will be recognised as necessary provided it can draw thirty children from some neighbouring school.

The Bill is defective in not providing that the education commenced under the code in the elementary schools should be continued in the department of higher education, whether in evening, technical or secondary schools. The only correlation attempted consists in the putting all schools within a given area under one local authority; but it does not ensure that there should be any organic connection or unity of aim between the lower and the higher schools.

I cannot help thinking that men and women elected for the express purpose, and subject to periodical re-election, are the most likely to support the more modern and practical views of education and so to enable the children under their charge to become more intelligent and valuable members of the community. J. H. GLADSTONE.

17 Pembridge Square, April 26.

Resultant Tones and the Harmonic Series.

MISS DICKINS's method of determining from the harmonic series the resultant tone would be of more worth than it is if it did not yield results which are untrue to the facts. These, as is, or ought to be, well known from the observations of the late Dr. Koenig, in some cases differ from those assumed. For example, the combination of two pure tones of the ratio 9 : 4 does *not* yield as the resultant tone 5. And in the case of the ratio 8 : 5 the resultant tone actually heard is just as likely to be 2 as 3, or both may be heard. The remark that the method is evidently as applicable to summational as to differential resultant tones is evidently made in ignorance of the circumstance that the "summational" tones are not, in fact, ever heard if the two fundamental tones are *pure*. They are one of the myths of science. SILVANUS P. THOMPSON.

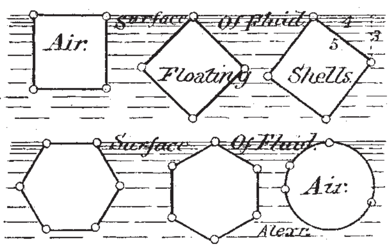
April 19.

Thin Floating Cylinders.

IN a letter to NATURE of February 18, 1897, I pointed out that a thin cylindrical floating shell was in equilibrium under the actions of its own weight and the external fluid load, the shell having its axis horizontal and just touching the surface or else completely submerged. The method was that of Rankine's conjugate load-areas, and building on this Dr. Thomson and myself made practical graphical solutions of the circular masonry arch; these were privately printed and circulated, and

met with the approval, among others, of Prof. Perry, London, and Prof. Malverd Howe, America. In revising this matter for the new edition of our "Applied Mechanics," I find that polygonal cylinders of uniform plates freely hinged at their edges and displacing their own weight of fluid and lying horizontally are also in equilibrium, provided the polygon be regular.

In the diagram the square shell is shown just reaching the surface and rolled into three positions. The proof is the same as for the ordinary statical problems on festoons of rods hinged at the ends, only now there is the external fluid pressure in addition to the weights. The fluid is kept out by face plates at the ends, the face plates having the same density as the fluid and being quite smooth, so as to allow the shell freely to change its shape. If the shell be slightly compressed it will collapse, but



the friction of the face plates and the confined air afford a slight degree of stability. The diagram shows the regular hexagonal shell, and by increasing the number of sides we arrive, as before, at the circular cylinder. In the polygonal shells there are bending moments on the sides as well as the thrust, but on the circular there is only hoop thrust, as it may be a plenum of joints. Submerging only adds a symmetrical load all round, and the shells are still balanced. As they are also balanced with the axis vertical it follows that they are in equilibrium in any position whatever.

My first letter led to some correspondence, and I hope this may be of interest to your readers. THOS. ALEXANDER.

Trinity College, Dublin, April 19.

Mycoplasm.

SINCE 1889 a fungus hyphal layer has been known to exist in the nucellar remnants of the grains of the Darnel grass, *Lolium temulentum*, and to these hyphæ have been attributed the poisonous properties of the Darnel. Later investigations have shown that the fungus could be found in the growing point of developing plants, in the inflorescence, and finally in the ovular rudiments. The manner of entrance of the fungus had, however, escaped detection. Nestler (*Ber. d. deutsch. bot. Gesellsch.*, B. xvi., 1898, p. 210) and others failed to observe the fungus in the embryo in the mature grain. The hyphæ in the growing point could not be observed before the eighth day of germination.

Eriksson has recently[1] quoted the work of Nestler and others on the fungus of *Lolium temulentum* in support of his theory on mycoplasma. According to Nestler, the embryo does not contain the hyphæ, which appear in the seedling on the eighth day. In only one case was he able to see hyphæ in the embryo. In view of the support which this work appears to give to Eriksson's mycoplasma theory, an advance note on some of my results in the investigation of the fungus of *Lolium temulentum*, which has been carried on in the laboratory of Prof. Marshall Ward at Cambridge University, may be of interest. In appropriately stained sections of the embryo taken from the mature seed of *Lolium temulentum*, hyphæ in great abundance may be seen in the growing point, sometimes but two cells from the tip; these hyphæ may be traced to their point of entrance at the juncture of the coleorhiza and scutellum on the outer surface of the latter in the region of the median longitudinal plane of the scutellum. Previous investigators had entirely overlooked the presence of a considerable amount of mycelium in that part of the grain which lies directly against the scutellum in the median basal region, where it has grown around the end of the aleurone layer. The infection takes place apparently before the grain has reached complete maturity, as the fungus is well established in the ripe grain. There can, therefore, be no question here of mycoplasm, since direct hyphal infection can very easily be demonstrated. There is no evidence to prove that the fungus is a Uredine. The detailed results, with other particulars of the nature and development of the fungus, will be published soon.

April 20. E. M. FREEMAN.

[1] Eriksson, *Ann. des Sc. Nat.*, T. xv., 1902, p. 73, says:—"Les tentatives infructeuses d'A. Nestler d'apprendre à connaitre de quelle manière le champignon qu'on trouve presque toujours dans les fruits du *Lolium temulentum* est entré dans le cone végétatif de l'embryon du fruit amenent aussi la supposition d'un état mycoplasmatique latent."

Rearrangement of Euclid I. 1-32.

THE rearrangement outlined in my previous letter was devised to meet the difficulty which, as Prof. Bryan states, is the chief objection to Euclid's Elements as an elementary course. Beginners cannot solve riders because

(1) They do not grasp the reasons for Euclid's limited postulates and axioms, and never fairly understand the "rules of the game"; consequently their early attempts violate his conditions, and their rejection discourages.

(2) Too much time is occupied by the propositions, with the result that they regard them, not as tools, but as models, and imitate Euclid's methods of proof. There is nothing in 1–8 worthy of imitation.

(3) They do not distinguish between data and quæsita unless they have drawn accurate figures. It is impossible to draw accurate figures by proved methods in Euclid's scheme (*e.g.* I. 4), and we therefore have recourse to figures drawn on the principle of Artemus Ward's horses. This is the great difficulty in working riders. Allow a boy to assume the mid-point of a line and he will assume the most impossible constructions. He should never be allowed to quote a construction which he cannot perform, and no construction should be shown him without proof. Freehand copies of blackboard figures are useless; if he has drawn a dictated figure, there is no confusion between hypothesis and conclusion. There is also the additional advantage that the less intelligent feel that in drawing the figure they have accomplished something, and this frequently stimulates to further effort.

To remove these difficulties we must extend the axioms and postulates, reduce the number of standard propositions, and introduce problems as early as possible. The advocates of a purely theoretical scheme have two courses open to them—either they must teach constructions first without proof (which is extremely illogical), or they must postpone them until the completion of the theory, and therefore postpone riders indefinitely. Geometry without riders resembles arithmetic without examples.

In the scheme which we have found most successful, riders commence with the definitions. Every standard proposition is treated as a rider and evolved by the class; one proposition a fortnight is considered sufficiently rapid progress, the intervening lessons being devoted to riders.

The circle gives a method of drawing equal lines, and, with the idea of angular measurement, a method of constructing equal angles. Of course we assume the shape of the circle.

I. 15 and 32 give the fundamental fact of rotation and introduce easy theorems and numerical examples.

I. 8 with its riders elicits I. 9, and I. 4 is followed by I. 10, locus of points equidistant from two given points, I. 11, 12, 5. Having reached this point, possible riders are endless, and the only difficulty lies in their selection; many propositions of III. and IV. may be included in the riders. Every pupil can now draw an accurate figure from dictation, and knows exactly what data he has to work upon. The rate of progress may appear slow, but we are teaching Book VI. in the second year. It should be noted that I. 1 is a rider, 20 an axiom, and that 2, 3, 7, 18, 19, 21, 24, 25 are not read.

In teaching riders, theorems should, as a rule, be grouped on methods of proof; the required figure should be dictated and the class asked to prove any fact they can concerning it. A general enunciation should then be invented; in this way standard propositions for future proof are frequently suggested. It is a mistake to hurl a general enunciation at a class of beginners. Problems usually give more trouble, but if grouped on loci their difficulties vanish.

There would be no examination difficulty if papers were set on riders only. Euclid's Elements might then be reserved for university examinations—a geometrical "Paley."

Leyton Technical Institute, April 25. T. PETCH.